Form ESA-B4. Public Report for ESA-160-3
FINAL

Company	Carpenter Technology Corporation	**ESA Dates**	8/19/2008 – 8/21/2008
Plant	Reading, PA	**ESA Type**	Process Heat
Product	Steel	**ESA Specialist**	Bob Scott

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction: Bob Scott performed a three day Energy Savings Assessment at the Carpenter Technology manufacturing facility in Reading, PA starting August 19, 2008 and ending August 21, 2008. The Carpenter Technology facility produces approximately100,000 tons per year of various grades of specialty alloy stainless steel which is sold primarily in the automotive, aerospace, medical and power generation markets as well as a wide variety of industrial and consumer industries. The process heat assessment focused on the 100+ various process furnaces fueled by natural gas.

Objective of ESA: The objective of the ESA was to assist the plant in obtaining a better understanding of energy savings opportunities in each process heat application, and to evaluate overall energy management practices.

Focus of Assessment: The focus of the assessment was to help the facility better understand overall energy usage in the manufacturing process and to provide an energy balance for utilization of natural gas. The PHAST tool was introduced to the staff at the facility to obtain a process heat balance for the plant and to model selected furnaces. The PHAST tool was then applied to identify and quantify opportunities for energy savings.

Approach for ESA: The approach for the ESA was to hold a kick off meeting with the plant lead and staff members of the energy team at the start of the ESA. Detailed discussions followed on the current operation. In the afternoon of the first day the majority of the plant was toured in order to gain a better understanding of process heat energy savings opportunities by furnace type. The second day was spent gathering data from the plant energy report and individual furnace manuals. Furnace wall temperature measurements were taken on selected furnaces. The PHAST energy balance was created from the plant energy report. Selected furnaces were modeled to identify specific energy savings opportunities. The plant lead and technical support personnel were then trained on PHAST. On the third day the preliminary findings for energy saving opportunities were reviewed with the team and presentation followed. The recommendations were reviewed with the team, and a detailed discussion followed.

General Observations of Potential Opportunities:

- Total plant natural gas usage for the base year (2007) was 2,600,000 MMBtu as provided in the ESA application. In excess of 90% of the natural gas is used for process heat applications.

- The total plant electrical usage for the base year was 336,000,000 kWh. Approximately 30% of the electric usage is for process heat applications (melting).

- Electrical usage in process heat equipment was not evaluated, as the electrical process heat applications had limited opportunities for energy improvements.

- The plant is very well run and the energy metering and monitoring program is extensive. However the mill experiences relatively high energy usage per pound due to the trend toward production of higher value alloys which require multiple heating steps. The energy usage at the mill has remained steady over the past several years although usage per ton is increasing. Most furnaces are underutilized in terms of available capacity and there are opportunities to achieve energy savings by scheduling the furnaces to run at higher loading rates. Heat recovery applications are limited in many of the furnaces due to nature of the batch processing and multiple heating steps.

- General recommendations that would result in natural gas energy savings include consideration of preheating charge material whenever technically feasible with furnace exhaust gases; scheduling and coordination to increase furnace utilization; consideration of burner replacements on furnaces that are not candidates for regenerative burners as most burner systems are oversized, resulting in high excess air at low firing rates; regenerative burners should be considered for new furnaces and retrofits where economically feasible.

Plant Process Heat Savings

Three specific opportunities to save energy used for process heat were identified during the ESA and the follow-up evaluation. A brief summary of each recommendation is described below:

#1 Walking Beam

The #1 Walking Beam furnace in the #5 hot mill should be strongly considered for a retrofit with regenerative burners. Results from a similar retrofit to the #2 Walking Beam furnace that sits beside it show annual energy savings of 49,333 MMBtu. This is considered a **medium term** opportunity for energy savings as capital investment is higher than for the #2 Walking Beam system as the charging mechanism must be reconfigured. The PHAST model for this furnace actually predicts savings of 94,164 MMBtu per year with the regenerative burner retrofit, but the model understated the metered natural gas usage of #2 Walking Beam, so the observed values are recommended for the comparison.

Rotary Forge Furnace Preheat

The Rotary Forge furnace has 43 natural gas burners that fire from the perimeter walls of the furnace. As this furnace is not a good candidate for regenerative or recuperative burners, the opportunity to preheat the charge material to 1200 degrees F was evaluated using the PHAST model. The charge could be preheated with the exhaust gases that are ducted under the floor to an external stack. Energy savings from implementation of this recommendation are identified at 26,800 MMBtu per year. This is considered a **medium term** opportunity for energy savings due to capital investment involved in the modification to the exhaust system.

#5 Mill Batch Furnaces

The #5 mill contains 10 batch furnaces of similar design that have exhaust temperatures of 1800 degrees F. The opportunity to tie the exhaust stacks together and feed an unfired preheater to heat the charge material to 800 degrees F was evaluated based on the PHAST model that was created for the E Batch Furnace. Annual savings of 25,200 MMBtu per year were identified for all 10 furnaces. The results could actually be significantly higher as the PHAST model understated the natural gas usage of the E Batch Furnace by almost 50%. This is considered a long term opportunity as the engineering and capital costs of this measure need to be studied in detail for technical and economic feasibility.

The estimated reductions in natural gas usage are 2.93% from the two **Medium Term** opportunities and 0.97% from the two **Long Term** opportunities identified.

Management Support and Comments:

DOE Contact at Plant/Company: The ESA was well received by plant energy team personnel. The DOE plant contact for follow-up is Bernie Mara, Vice President Advanced Engineering.